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NOVEL MACROMOLECULAR STRUCTURES AND COMPOSITES(U)  
MASSACHUSETTS UNIV AMHERST DEPT OF POLYMER SCIENCE AND  
ENGINEERING F E KARASZ JUN 85 AFOSR-TR-86-0143

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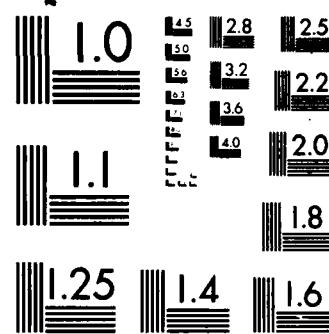
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FINAL REPORT

RESEARCH EQUIPMENT: DOD UTRIP

NOVEL MACROMOLECULAR STRUCTURES  
AND COMPOSITES

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AFOSR

Grant AFOSR 83-0341

1 August 1983 - 31 July 1984

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19. ABSTRACT (Continue on reverse if necessary and identify by block number)   The grant provided funds for the purchase of a "DYNASTAT" Mechanical Testing Apparatus. This apparatus was made fully operational late in 1984 and has been used extensively by a number of DoD supported PI's in the UMass polymer community. It is the most versatile and sophisticated mechanical testing device available and completely fulfills the URI goal of providing modern facilities for advanced research to university researchers relevant to DoD interests.											
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AIR FORCE OFFICE OF SCIENTIFIC RESEARCH (AFSC)  
NOTICE OF APPROVAL AND RELEASE  
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MATTHEW J. McGRATH  
Chief, Technical Information Division

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I. TITLE: Research Equipment: DoD URIIP

II. PRINCIPAL INVESTIGATOR: Dr. Frank E. Karasz  
Polymer Science and Engineering  
University of Massachusetts  
Amherst, MA 01003

III. CONTRACT NUMBER: AFOSR 83-0341

IV. DATES: 1 August 1983 - 31 July 1984

V. SENIOR RESEARCH PERSONNEL: None

VI. JUNIOR RESEARCH PERSONNEL: None

## VII. ABSTRACT OF ACCOMPLISHMENTS

The grant provided \$100,000 towards purchase of a "DYNASTAT" Mechanical Testing Apparatus. This apparatus was made fully operational late in 1984 and has been used extensively by a number of DoD supported PI's in the UMass polymer community. It is the most versatile and sophisticated mechanical testing device available and completely fulfills the URIP goal of providing modern facilities for advanced research to university researchers relevant to DoD interests.

## VIII. DESCRIPTION OF ACCOMPLISHMENTS

The Dynastat mechanical testing instrument purchased under the URIP Grant is now fully operational. It is presently being used to a large extent for research involving the Farris research group. The projects primarily influenced and which constitute about 90% of the time on the instrument are the AFML Molecular Composites Program and a DoD LOVA program. The instrument is sufficiently versatile that it can be used for a multitude of materials and is especially useful for very stiff materials, a region where most instruments fail.

As an example of the type of data that can be taken we have included some recent data. Figure 1 illustrates the in-phase modulus in uniaxial compression of a polyacetal-polyurethane thermoplastic elastomer as a function of frequency at several temperatures. Figure 2 shows the master curve for this material using the computerized timer-temperature/frequency-temperature shifted data. Also included in this figure are the reduced data at 40% and 60% filler content.

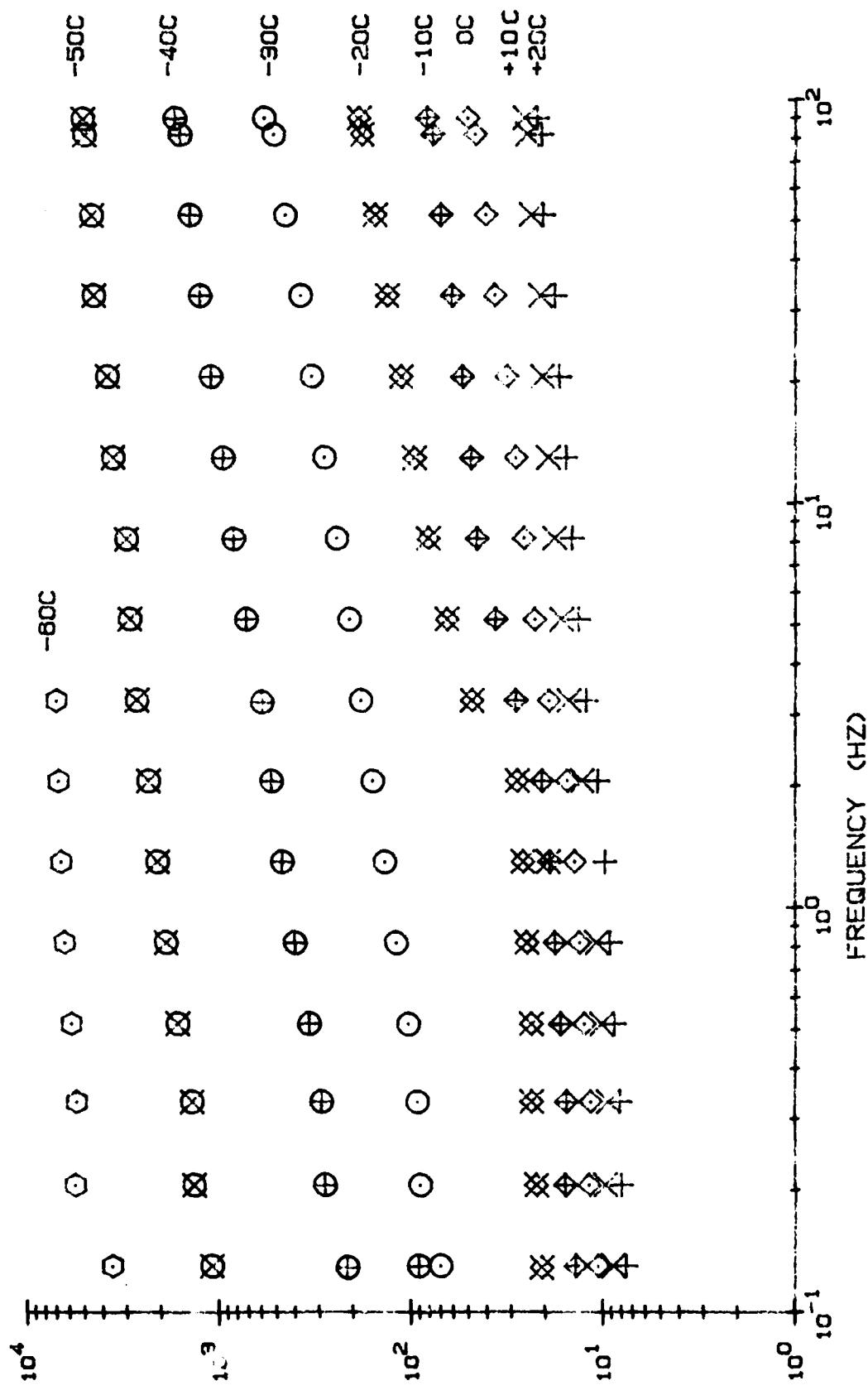
Figure 3 shows the curing of a graphite-epoxy prepreg in shear during cure. In this experiment the sample is being increased in temperature linearly with time. The prepreg softens at about 50°C and little happens until 160°C where reaction commences, as illustrated by a drop in the loss factor and an increase in the stiffness.

This instrument is perhaps the most versatile mechanical testing apparatus in the department and can do many different types of experiments including creep, stress-relaxation, dynamic, etc. It can sweep frequency and temperature automatically and is fully computerized. It is currently being used to develop

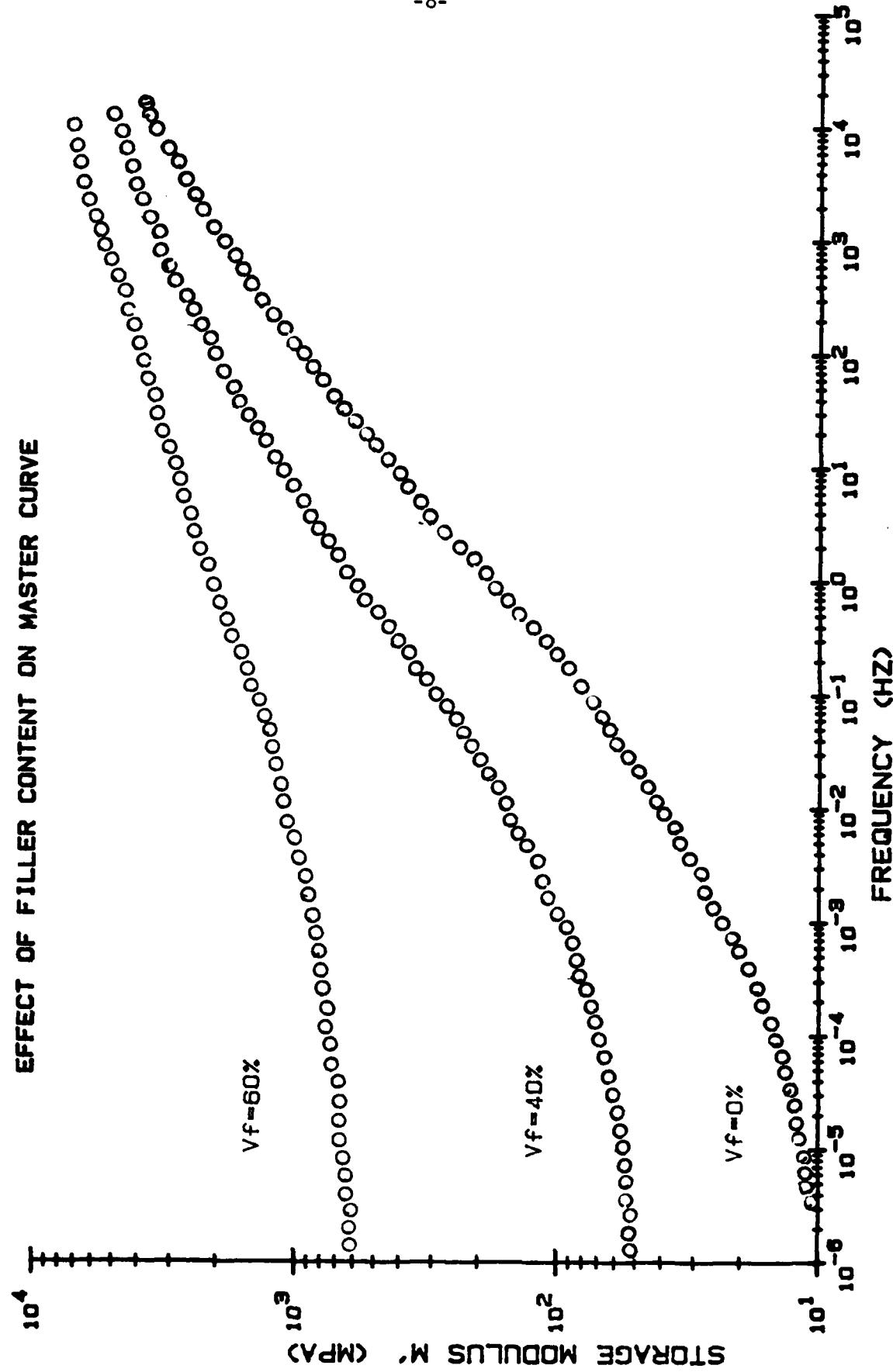
a new Impulse Method of Viscoelastic characterization which related time-integrals of stress to time integrals of strain for pulse experiments. This work will be presented by R. Farris at the Gordon Research Conference on Thermosets in July 1985. Such work would have been impossible without the Dynastat.

PACPU-MBI-1800-0X IN COMPRESSION

M' (MPA)

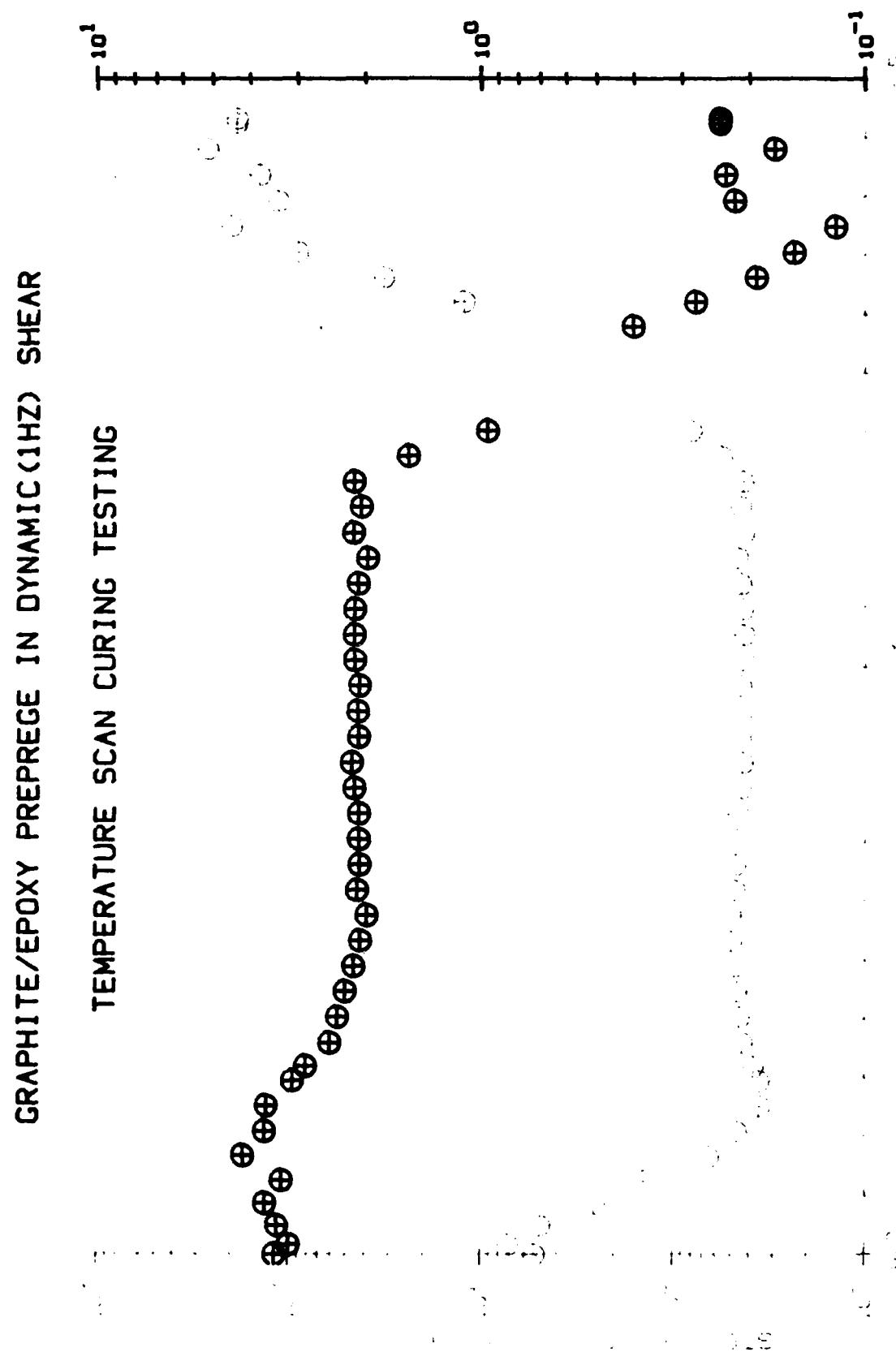


EFFECT OF FILLER CONTENT ON MASTER CURVE



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### LOSS FACTOR M.../M



IX. PUBLICATIONS

None.

The "Dynastat" has been operational for some 6 months at the time of writing. We anticipate very heavy usage in the foreseeable future in a highly productive mode. A large number of publications with data entirely or partially attributable to this apparatus is anticipated.

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